

U.S. Department of Energy
Statement before the City of New York, Borough of Brooklyn,
Community Board #7

Thank you for the opportunity to speak about the use of natural gas buses for public transit. Our testing, evaluation, scientific analysis, and experience leads us to conclude that natural gas buses are one of the leading choices for transit systems considering alternatives to conventional diesel buses, and certainly the most popular--natural gas buses now account for 20% of all new transit bus orders.

Recent reports in the press have highlighted the opportunities for advanced technologies to also meet the needs of transit agencies. For example, a recent New York Times article (February 15, 2000) suggests that prototype hybrid diesel buses have the same emissions as natural gas buses. Indeed, there are numerous technologies and fuels under development that can help reduce emissions and reduce oil use. However, we become concerned whenever articles or coverage misstates some of the evidence that has been collected. It takes a very conscientious effort to implement a clean bus program, and poor research and poor comparisons will not lead to the best decision.

Let's use the Times article to illustrate the point. The article was based on a recently released report on laboratory emissions testing of various buses. Contrary to the impression left by the article, the report documents that natural gas buses have the lowest smog-forming, particulate matter, and toxic emissions of any of the buses tested.

First of all, let's examine the types of buses tested in the study. The diesel hybrid buses tested are prototypes that use emission control hardware not commercially available, and very low-sulfur diesel fuel that is not widely available, and likely to be more costly than current diesel fuel which has recently exceeded \$2 per gallon. The natural gas buses used in the study were not prototypes--but actual buses that had been used in service. So prototype hybrid buses were compared to commercial, in-service natural gas buses.

Despite these differences, the natural gas buses had the lowest PM and NOx emissions as the report clearly states. However, this still handicaps the emissions results from the natural gas buses. Because of the efficiency increase due to the hybrid powertrain, the diesel hybrid buses used only about half to three-quarters of the fuel that the natural gas buses did. If natural gas engines had been used in the hybrid buses, their emissions would have been lower, even without taking into account the favorable operating cycle for the engine in the hybrid powertrain.

The report also did not measure ultrafine particulates or toxic emissions. Despite the low PM emissions from the hybrid buses, it has been demonstrated that diesel fuel produces toxics that are adsorbed onto the particulate. For this reason, California has determined that diesel particulate is a toxic air contaminant and the California Air Resources Board is taking steps to control diesel particulate. The combustion of natural gas itself produces little or no PM emissions, and the PM and toxics measured from natural gas buses are from the petroleum-based lubricating oil of the engine.

Diesel engines using diesel fuel have also been shown to produce high numbers of ultrafine particulates. Ultrafine particulates are being extensively studied because there is concern that they are a significant health hazard. What we know is that the combustion of natural gas produces inherently low numbers of ultrafine particles compared to the high molecular weight molecules in diesel fuel, no matter how clean it is.

Sometimes what works in the lab may not work as well on city streets. As the report pointed out, natural gas buses have always had low PM and NO_x emissions despite having few emission control devices because combustion of natural gas is inherently clean. As we know from gasoline vehicle experience, catalyst-based emission control technology is highly dependent on the quality of the fuel and will in the best of circumstances degrade over time. Experience with natural gas vehicles has demonstrated slower deterioration of emission control devices because natural gas contains no sulfur and is very clean. Furthermore, the emission control devices employed in the prototype hybrid buses used in the report are very dependent on consistent fuel quality. The very low-sulfur diesel fuel needed to assure durable operation of the emission control technology used by the hybrid buses of the report is not likely to be widely available for 8-10 years. In short, the probability and consequences of emission control failure in CNG buses are less than for diesel buses with advanced emission controls.

In addition to being very clean, natural gas buses do more to reduce the reliance of the transportation sector in the U.S. on imported petroleum fuels than even hybrid buses. While hybrid buses use only about half of the diesel fuel of conventional diesel buses, natural gas buses use none. The U.S. transportation sector is still dependent on petroleum fuels for 95 percent of total energy needs. As evidenced by the recent run up in crude oil and diesel fuel prices, this nation truly needs alternatives to oil in our transportation system. Natural gas buses can also help reduce emissions of greenhouse gases compared to conventional diesel, and hybrid technologies help reduce greenhouse gas emissions for both natural gas and diesel.

The use of natural gas transit buses has also been criticized as being more expensive than diesel buses. However, the hybrid buses in the report are reported to cost about \$100,000 more than

conventional diesel buses while natural gas buses cost about \$30,000 to \$50,000 more. In addition, natural gas costs considerably less than diesel fuel, and has risen in price only half as much as petroleum over the past 6 months, during which crude oil has gone from \$10 per barrel to \$30 per barrel. We estimate that many transit operations could save as much as 40 cents per gallon equivalent of fuel used.

Criticisms have also been levied at the safety of natural gas buses compared to diesel buses. Our experience, and that of dozens of transit systems around the country, is that there is no basis on which to say that natural gas is less safe than diesel fuel. All fuels carry risks. Usually the type of risks are different for each fuel type. With proper equipment, training, inspection and maintenance, these risks can be addressed and minimized. Conventional diesel buses are not without risks. Hybrid diesel-electric vehicles are not without risks, indeed, the use of high-voltage equipment, batteries, and electronic equipment on a hybrid bus will require changes in emergency procedures that have yet to be fully developed. Fuel cell buses, which are being developed and could become available during the next 10 years, will raise a different set of risks that must be addressed. Our conclusion is that all these technologies can be made very safe for transit buses by taking the proper precautions.

Natural gas buses are not perfect, nor would they be expected to be. Natural gas buses require a different infrastructure, different refueling, different training, etc. They are often heavy. The tanks take up space. One could make a similar list of drawbacks to any of the new technologies and, for that matter, for the conventional diesel buses as well. A conscientious review of all the costs and benefits of various approaches is critical to choosing the right technology and fuel for each specific transit application.

In summary, our experience leads us to conclude that natural gas buses are the leading alternative choice for transit buses. Advanced technology buses, currently under development, may well become excellent choices during the next several years. We believe a fair and objective comparison of the costs and benefits of these approaches is possible, and we know that in many communities around the country, that comparison is leading to the selection of natural gas buses.

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Office of Transportation Technologies